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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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Federal Communications Commission
Office of Secretary

In the Matter of:	)	
	)	
Petition of the Intelligent	)	
Transportation Society of America	)	
for Amendment of the Commission's	)	RM________
Rules To Add Intelligent Transportation	)	
Services (ITS) as a New	)	
Mobile Service With Co-Primary Status	)	
in the 5.850 to 5.925 GHz Band	)	

PETITION FOR RULEMAKING

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SUMMARY

ITS America hereby requests an allocation of 75 MHz of spectrum in the 5.850-5.925 GHz band for use by intelligent transportation systems ("ITS"). This allocation, in particular, is requested to provide for the use of Dedicated Short Range Communications ("DSRC") based systems in the deployment of a nationwide ITS infrastructure. DSRC systems provide a short range, wireless communications link between vehicles traveling at highway speeds and roadside systems. This communications link provides the key to multiple vehicle-based services that will dramatically improve traveler safety, decrease traffic congestion, reduce air pollution and inefficient use of fossil fuels, and improve the nation's productivity overall both on and off the roadways.

The benefits of DSRC have already been proven in nascent deployments across the country. Toll authorities in at least 16 states have installed DSRC electronic toll collection systems that allow cars to pay tolls automatically without stopping. Commercial vehicle operators and highway departments have installed DSRC "weigh-in-motion" and automatic safety check and electronic clearance stations that allow states to weigh trucks, check permits, track hazardous materials, and authorize further inspections if necessary, without slowing a truck's progress along the highway. Emergency response vehicles and bus drivers will have improved response time and schedule adherence with DSRC control of traffic signals. Traffic managers have reduced the amount and length of traffic jams with the use of DSRC traffic probes. These first generation DSRC systems have brought significant benefits to the traveling public and have far surpassed initial market forecasts in their usage. They are also engendering public acceptance of, and familiarity with, ITS services and demonstrating the many public benefits attainable from a widespread ITS deployment. The continued availability and operation of these systems is thus

essential to the accomplishment of the Congress' objectives as called for in the Intermodal Surface Transportation Efficiency Act of 1991 ("ISTEA").

Much more, however, can and should be done with DSRC systems to attain the widespread ITS implementation called for in ISTEA. Existing DSRC systems have been deployed under the "Location and Monitoring Service" authorized in the 902-928 MHz band. This band, however, is simply too small and too congested to support the ubiquitous deployment and national interoperability of all of the many existing, emerging, and future DSRC applications. This band also fails to provide the level of protection necessary to deploy many public safety-related DSRC services employing billions of dollars of public and private infrastructure investment. A spectrum allocation in which all current and proposed DSRC systems can operate nationwide will propel DSRC development a long way towards its ultimate goal: increasing the safety and efficiency of individual drivers through the installation of one, affordable vehicle transponder that can communicate with DSRC transceivers performing multiple functions across the country. This Petition, therefore, requests a spectrum allocation for second generation DSRC systems to accommodate the widespread ITS deployment established as a national priority by ISTEA.

An allocation of 75 MHz in the 5.850-5.925 GHz band is necessary to meet the goals of the ITS program, protect the operations of existing licensees, and accommodate new licensees currently authorized in this band. The attached report regarding DSRC spectrum requirements, prepared by ARINC for the Federal Highway Administration ("FHWA") of the Department of Transportation ("DOT"), provides a case study analysis of the bandwidth required to support the robust deployment of the eleven DSRC user services described herein. ARINC's report demonstrates a case for eight channels of six MHz each within a 75 MHz allocation to provide for flexibility in channel frequency assignment to avoid or minimize interference with other users in and near the band.

ARINC's report reflects one possible second generation DSRC architecture. However, there are competing technical approaches emerging in industry to achieve this second generation DSRC deployment. ITS America, accordingly, does not endorse by this Petition any particular technical approach or solution, but rather urges a spectrum allocation based upon ongoing consensus building efforts in the industry that will enable the public to realize the benefits of a widespread deployment. A 75 MHz allocation will support existing, emerging and future DSRC applications and standards, co-existent with existing uses of the band, while ensuring that public-safety applications will operate with sufficient protection from harmful interference. This is especially critical to provide a sound basis for the expenditure of the public dollars required to realize a second generation DSRC deployment. Finally, the requested spectrum allocation will help realize the goal of transponder affordability in a spectrally efficient manner so that the safety- and mobility-enhancing benefits of DSRC systems can and will be widely achieved, as directed by Congress.

In the industry efforts leading to filing of this Petition, a number of alternative spectrum solutions were considered to attain a robust DSRC allocation. The spectrum studies for candidates for the DSRC allocation focused on three criteria: (a) the availability of an adequate amount of spectrum to support the robust DSRC deployment; (b) the adequacy of the band environment concerning compatibility with existing users of the band; and (c) the feasibility of the band in supporting the economies required to achieve universality. Given these considerations, the 5.850-5.925 GHz band presents the best candidate. The requested band provides adequate spectrum and spectrum flexibility to accommodate the anticipated DSRC uses and presents an environment with minimal sources of interference, so that safety-critical functions can be performed in a timely and reliable manner. Moreover, the 5.850-5.925 GHz band offers ideal propagation characteristics for DSRC and is very close to the band proposed for DSRC deployment in Europe and Asia, amplifying opportunities for U.S. manufacturers to realize economies-of-scale and opening up international markets for DSRC products.

An estimated $425 billion will be spent on ITS projects in the United States by the year 2015. DSRC systems are being and will continue to be widely deployed across the U.S. and the world. Previously unimagined uses for and unanticipated benefits of these systems are being discovered every day. ITS America asks the Commission to take the opportunity before it to ensure that DSRC deployment occurs in a timely and sensible fashion by allocating 75 MHz of spectrum to DSRC for ITS uses in the 5.850-5.925 GHz band.

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I. INTRODUCTION

The Intelligent Transportation Society of America ("ITS America"), by its counsel and pursuant to Section 1.401 of the FCC's Rules, 47 C.F.R. § 1.401, hereby petitions the Commission to commence a rulemaking proceeding to amend Subpart M of Part 90 of its Rules to allocate on a co-primary basis the 5.850-5.925 GHz band for use by intelligent transportation systems ("ITS").[1] This allocation, in particular, is requested to provide for the use of Dedicated Short Range Communication ("DSRC") based systems in the deployment of a nationwide ITS infrastructure. The requested spectrum allocation will further the national priority in enabling the interoperable ITS infrastructure established by Congress in the Intermodal Surface Transportation Efficiency Act of 1991 ("ISTEA").[2] As shown herein and in the attached Appendices, the requested spectrum allocation first and foremost will improve the safety of this nation's transportation infrastructure for use by the traveling public. This allocation, moreover, will enhance the efficiency of use of the transportation infrastructure, improve mobility and reduce traffic congestion, enable quicker emergency incident response from public safety agencies, improve safety inspections of commercial vehicles while reducing costly weigh station and border crossing delays, reduce health care costs attributable to traffic accidents, improve the management and security of the flow of hazardous materials throughout the nation and help realize billions of dollars of gain in economic productivity. The requested spectrum allocation, moreover, will promote U.S. leadership in the emerging world markets for intelligent transportation systems and

[1] This Petition reflects the views of ITS America developed consistent with the telecommunications policy established by its Board of Directors. This Petition does not necessarily reflect the views or position of each of the individual members of ITS America.

[2] 105 Stat. 1914, 102 P.L. 240 (1991).

products. ITS America, accordingly, requests the FCC to commence expeditiously the rulemaking proceeding contemplated herein.

II. BACKGROUND

A. ITS America

ITS America is a nonprofit, educational association dedicated to the development and deployment of intelligent transportation systems to improve the safety and efficiency of the nation's transportation infrastructure. Since its inception in 1991, ITS America has provided a leadership role in the public/private partnership to deploy ITS. In this capacity, ITS America serves as a Utilized Federal Advisory Committee to the U.S. Department of Transportation ("DOT") under the Federal Advisory Committee Act.[3] In addition, ITS America coordinates and represents its members in ITS matters, including participating in proceedings and rulemakings before the FCC to help realize the implementation of policies to promote the deployment of ITS user services throughout the United States consistent with the mandates of ISTEA.

The organization's members are drawn from all facets of business, the academic community and government which have a stake in the application of technology to transportation. Over 350 of ITS America's members are corporations involved in the provision of transportation goods and services. Collectively, these members are representative of the entire transportation industry in the United States and a significant percentage of the worldwide transportation industry. Another approximately 135 members represent federal, state and municipal transportation agencies with responsibility for the deployment, oversight and management of the nation's transportation infrastructure. In addition, approximately 75 research institutions and universities contribute their

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[3] 5 U.S.C. Appendix.

insights and innovations in the field of surface transportation as members of ITS America. These members and others are identified on the ITS America membership list attached as Appendix A.

ITS America has worked closely with DOT, its members and others to identify and develop the long-term application and spectrum needs for ITS in general and DSRC in particular. These efforts have produced, among other things, a Strategic Plan published by ITS America in July of 1992 that provides goals, objectives and milestones for ITS development for the next 20 years.[4] ITS America's Strategic Plan served as the basis for DOT's ITS strategic plan submitted to Congress in 1992. From 1993-1995, ITS America and DOT worked together to develop a National Program Plan that delineates specific tasks to be accomplished in order to realize the goals of the Strategic Plan.[5] In addition, from 1993 to the present, ITS America and DOT have been developing a multi-volume ITS "National Architecture." The National Architecture, which was recently completed, describes fundamental guidelines for the logical and physical exchange of information required in the design of interoperable intelligent transportation systems. Finally, ITS America has coordinated and will continue to coordinate substantial standard-setting efforts for all telecommunication aspects of intelligent transportation systems.[6]

B. Increasing Burdens Are Being Placed on the Nation's Transportation System

Although ITS has been the subject of research and development for nearly a century, the last decade has seen explosive growth in both the need for and deployment of intelligent

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[4] IVHS America, *Strategic Plan for Intelligent Vehicle-Highway Systems in the United States* (May 20, 1992) ("*Strategic Plan*") (excerpts attached as Appendix B).

[5] *National ITS Program Plan,* edited by Euler, G.W. *et al.* (March 1995) ("*National Program Plan*") (attached as Appendix C).

[6] *See, e.g.*, ITS America, *Dedicated Short Range Communications Standards Update* (Oct. 3, 1996) (attached as Appendix D).

transportation systems.[7] Much of this growth is due to the enormous transportation safety and mobility challenges facing the nation today -- challenges that will only be met with ITS.

Tens of thousands of people die and millions more are injured on the nation's roadways annually. In 1993 alone, motor vehicle accidents caused the death of 35,747 people[8] and injured 3 million more.[9] From 1989 to 1993, police received an annual average of over 6 and a quarter million vehicle accident reports.[10] During this same period, the total comprehensive cost to the nation of motor vehicle accidents exceeded an annual average of $400 billion.[11]

Moreover, in 1987 alone, Americans lost over 2 billion hours (approximately 22,800 years) sitting in traffic jams.[12] Washington, D.C. tops the list of the nation's most congested cities with each driver wasting an average of 70 hours per year idling in traffic.[13] These lost hours represent an economic loss of $42 billion in just the 25 most populous U.S. cities.[14] Even more

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[7] *See* Appendix E for a brief history of ITS.

[8] *National Program Plan* at 7.0.1.

[9] U.S. Department of Transportation, Federal Highway Administration, *ITS Architecture: Executive Summary* at 1 (June, 1996) ("*ITS Architecture: Executive Summary*") (attached as Appendix F).

[10] Wang, J.S. *et al.*, "Motor Vehicle Crash Involvements: A Multi-Dimensional Problem Size Assessment," *Proceedings of the 1996 Annual Meeting of ITS America*, vol.2 at 934, 943 (April 1996).

[11] *Id.* at 9. Comprehensive costs include direct economic losses, pain and suffering and loss of life. *Id.* at 3-4.

[12] *ITS Architecture: Executive Summary* at 1.

[13] Streisand, B., "Message in a bottleneck: It's time to start charging rush-hour commuters," *U.S. News and World Report* at 47, 50 (Dec. 30, 1996-Jan. 6, 1997) ("*Message in a bottleneck*") (San Francisco and Los Angeles rank number two and three on the list with commuters sitting in traffic an average of 66 hours and 65 hours per year, respectively).

[14] *ITS Architecture: Executive Summary* at 1.; *see also id.* at 47 ("Gridlock costs Americans roughly the equivalent of $51 billion a year in lost wages and wasted fuel. And the situation is only going to get worse").

alarming, this figure is on the rise.[15] Since 1986, car travel has increased by almost 40 percent, while highway capacity has barely grown.[16] Overall, the number of vehicle miles traveled by Americans doubled from 1 trillion to 2 trillion in the last 30 years, and is forecast to double again in the next 30 years.[17] Current trends predict that over 80 percent of urban interstate rush hour traffic will be congested by the year 2000.[18]

Transportation inefficiencies contribute to other problems as well. For example, emissions from transportation sources account for 43% of total emissions of nitrogen oxides, 31% of hydrocarbon emissions and 66% of carbon monoxide emissions in the United States.[19] Approximately one-half of the population of the United States lives in regions exceeding federal standards for smog and one-third of the population lives in areas exceeding federal carbon monoxide standards.[20] In addition, transportation sources are the nation's biggest consumer of

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[15] *ITS Architecture: Executive Summary* at 1 (the cost of congestion was $48 billion in 1992 -- a nine percent increase over the previous year). DOT estimates the total cost of inefficiencies on our nation's roadways to be $200 billion per year, including congestion costs and lost productivity. *See* U.S. Department of Transportation, *IVHS Strategic Plan: Report to Congress* (1992).

[16] *Message in a bottleneck* at 47.

[17] *National Program Plan* at 1.4.2. In contrast, from 1960 to 1987, the number of new highway miles increased by only nine percent. *Strategic Plan* at II-10.

[18] *ITS Architecture: Executive Summary* at 1. A recent study by the Greater Washington Board of Trade predicts that, by 2020, Washington area commuters will spend an additional 100 hours per year in traffic congestion, adding $345 million to the shipping costs of the local trucking industry. *See* O'Harrow, R., "High Cost of Idling," *Washington Post* at D1, col.1 (April 24, 1997).

[19] *Strategic Plan* at II-12.

[20] *Id.*

energy, accounting for 27% of total energy consumption and 63% of petroleum consumption in 1989.[21] About two billion gallons of fuel are wasted annually due to traffic congestion.[22]

These issues will not be solved simply through the construction of new roads. Studies have demonstrated that, more often than not, more roads simply produce more traffic: from other roads, from mass transit and from new developments that spring up along new routes.[23] Moreover, Congress has stated in no uncertain terms that the era of massive road construction and expansion is over.[24] Congress has also recognized that the construction of more roads will not address the severe air pollution problems found in many parts of the country.[25] Instead, Congress has turned to intelligent transportation systems as a clean, safe and affordable alternative to road construction that promises to alleviate the safety, mobility, environmental, and other vexing problems plaguing the nation's surface transportation system.

C. <u>Congress Has Attempted to Alleviate These Burdens Through Enactment of ISTEA</u>

Congress recognized the great potential of ITS in the Intermodal Surface Transportation Efficiency Act of 1991 ("ISTEA").[26] ISTEA codified as national policy the development of:

> a National Intermodal Transportation System that is economically efficient and environmentally sound, provides the foundation for the Nation to compete in the global economy, and will move people and goods in an energy efficient manner ... [that] shall

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[21] *Id.*

[22] *Id.*

[23] *Message in a bottleneck* at 47.

[24] 102 P.L. at § 2 (1991) (asserting that "[p]ractices that resulted in the lengthy and overly costly construction of the Interstate and Defense Highway System must be confronted and ceased"); *see also Strategic Plan* at II-19.

[25] *See Strategic Plan* at II-12.

[26] 105 Stat. 1914, 102 P.L. 240 (1991).

be adapted to "intelligent vehicles"... and other new technologies wherever feasible and economical.[27]

To carry out this policy, Congress established a national ITS program in the Department of Transportation. The program's mission, as defined in ISTEA, is to achieve:

(1) **the widespread implementation of intelligent vehicle-highway systems** ...;

(2) the enhancement ... of the efforts of the several States to attain air quality goals ...;

(3) the enhancement of safe and efficient operation of the Nation's highway systems ...;

(4) the development and promotion of ... an intelligent vehicle-highway systems industry in the United States...;

(5) the reduction of ... traffic congestion; [and]

(6) the enhancement of United States ... competitiveness ... by establishing a significant United States presence in an emerging field of technology....[28]

Congress also directed DOT to develop a strategic plan for ITS,[29] national standards for implementation to promote ITS compatibility throughout the states,[30] and a prototype of a fully automated highway by 1997.[31] Finally, Congress authorized funding of $659 million through 1997 to test and deploy ITS systems.[32]

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[27] 102 P.L. § 2.

[28] *Id.* at § 6052 (emphasis added).

[29] *Id.* at § 6054(a).

[30] *Id.* at § 6053(b).

[31] *Id.* at § 6054(b).

[32] *Id.* at § 6058. Congress appropriated over $222 million in fiscal year 1996 alone, and a total of over $800 million in the last four years, to develop and deploy Intelligent Transportation Systems (ITS). House of Representatives Report No. 104-177 at 82, Department of Transportation and Related Agencies Appropriations Bill (1996).

D. The Promise of ITS

The ambitious goals outlined by Congress in ISTEA are already being realized under implementation of the Strategic Plan. When the Strategic Plan was completed in 1992, experts estimated that ITS could reduce traffic fatalities and injuries by eight percent by the year 2011, saving an average of 3,300 lives and avoiding approximately 400,000 traffic-related injuries each year.[33] Based on the experience and knowledge obtained over the last five years, the National Highway Traffic Safety Administration ("NHTSA") now estimates that just three collision avoidance services out of the many safety-enhancing ITS applications can reduce traffic fatalities and injuries by at least 18 percent when fully deployed.[34] This translates into economic benefits of roughly $25.6 billion in avoided medical costs, emergency services, vehicle repair costs and other accident costs (not including the less tangible, but often more important benefits of prevention of pain, suffering and loss of life).[35] In addition, the Strategic Plan estimates that cities that adopt ITS can reduce traffic congestion by approximately 20 percent by 2011.[36] ITS can confer numerous other public and private benefits as well, including increased and higher-quality mobility, improved environmental quality and energy efficiency, improved productivity for commercial carriers and higher economic productivity overall.[37] Whether driving one of the approximately 134 million passenger cars, 1.6 million tractor trailers, 62 million other trucks,

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[33] *Strategic Plan* at 1-4.

[34] NHTSA, *Preliminary Assessment of Crash Avoidance Systems Benefits* at 7-1 (Oct. 1996).

[35] *Id.*

[36] *Strategic Plan* at 1-5.

[37] *Id.* at II-34 to II-37.

670,000 buses or 3.7 million motorcycles on the road today,[38] all 175 million licensed drivers in the U.S. can benefit from ITS.[39]

III. EXISTING, EMERGING AND FUTURE DSRC SERVICES CAN DRAMATICALLY IMPROVE SAFETY, MOBILITY, PRODUCTIVITY AND THE ENVIRONMENT ON OUR NATION'S ROADWAYS

Intelligent transportation systems achieve these benefits through the integration of advanced vehicle communications with infrastructure systems. Telecommunications form the backbone of all ITS applications since they rely heavily on the swift and accurate movement of information. Most ITS applications are being deployed within the framework of existing telecommunications systems, such as wireless broadcast, cellular technology and land-line communications. Indeed, reliance upon existing carriers and infrastructure, where appropriate, is one of the guiding principles of both the National Architecture and the Telecommunications Policy adopted by the Board of Directors of ITS America. Today, CMRS carriers, TV, radio, internet and PSTN-based service providers are increasingly providing ITS and ITS-related services such as traveler information. However, because of the critical safety functions of the DSRC user services, and the location-dependent nature of the information to be communicated over the DSRC links, the ITS National Architecture has identified a specific requirement for dedicated spectrum to serve the needs of DSRC.

Collectively, ITS America's Strategic Plan, National Program Plan and ITS National Architecture describe in detail the overall framework for ITS deployment. The framework is built around an evolving list of 30 "user services" subdivided into seven "bundles." User services define a group of products designed to meet the needs of ITS customers, including the traveling

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[38] FHWA, *1994 Highway Statistics* at VM-1(1994).

[39] *Id.* at DL-1A.

public, transit agencies, public safety organizations and others.[40] Many of these services are already widely used. Others, such as the automated highway system, are expected to be developed and deployed over a longer term. Some services are being deployed within the private sector as consumer products. Others are primarily government activities, and still others involve joint public-private deployment efforts.[41] All of the user services, however, require and are built around the concept of national interoperability, which provides the key to affording widespread access to increased vehicle safety, enhanced consumer mobility, the benefits of economies of scale, and ubiquitous public sector deployment of public safety services.

DSRC is indispensable to the widespread deployment of ITS. As the name implies, Dedicated Short Range Communications are utilized by those user services that require a short-range, wireless communications link between, in general, vehicles traveling at highway speeds and roadside systems.[42] The National Program Plan and ITS National Architecture have identified the need for this link in, at present, eleven ITS user services, described more fully below. These communications involve the transfer of highly time-critical and location-specific information.

[40] The services are not intended to describe every possible application of ITS; rather, they are meant to provide a platform for future innovation.

[41] Volume II of the *National Program Plan* describes in detail the ITS user services and the anticipated level of public and private involvement in the deployment of each service.

[42] DSRC systems consist of three basic elements: a transponder (tag), transceiver (reader), and transceiver antenna (beacon). The transponder is a processor-controlled data transfer device (read-only) or low-power transceiver (read-write) that stores data. Transponders may be mounted on the inside (*e.g.*, windshield or dash) or outside of the vehicle (*e.g.*, license plate or bumper). The transponder responds to communications sessions initiated by the transceiver.

The transceiver contains a more powerful processor and transmitter than the transponder. The transceiver controls all communications sessions and is usually installed in a cabinet alongside the roadway with the antenna mounted on or integral to a structure overlooking the roadway. Transceiver antennas can also be incorporated into existing traffic signs to minimize the need for additional roadside structures (to improve safety) and to camouflage the antennas (to minimize vandalism). Transceivers are available in both portable and hand held versions.

Thus, a permanent allocation with co-primary status for DSRC roadside installations is required to ensure secure and rapid transmission.

ITS user services employing DSRC links enable drivers to avoid many kinds of accidents and bottlenecks, resulting in improved driver safety and mobility, increased productivity and decreased vehicle-related air pollution. For example, one application called in-vehicle signing warns drivers in advance of slippery road conditions and other roadway hazards.[43] Slippery road conditions contribute to approximately 20 percent of all single vehicle roadway departure crashes.[44] Lack of attention to roadway conditions -- which can be remedied with a DSRC-based in-vehicle alert system -- contributes to another 15.5 percent of this crash type.[45] A DSRC-based intersection warning system signals drivers when a vehicle is approaching on a collision course or blocking the first driver's right-of-way.[46] Intersection collisions account for a full 30 percent of all accidents reported to the police (in 1993, approximately 1,805,000 accidents).[47] The automated highway system will virtually eliminate human error as a factor in vehicle collisions, disarming the cause of over 90 percent of all crashes.[48] Moreover, automated highway systems can increase vehicle-per-hour lane capacity by 200-300 percent, leading to a substantial decrease

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[43] *See infra* at III.B.3.a. for a complete description of in-vehicle signing.

[44] Najm, W.G. *et al.*, "Analysis of Target Crashes and ITS Countermeasure Actions," *Proceedings of the 1995 Annual Meeting of ITS America*, vol.2 at 931, 934 (March 1995). In turn, single vehicle roadway departures accounted for 20 percent of all crash types, which, in 1993, totaled approximately 6,093,000. *Id.* at 932.

[45] *Id.* at 934.

[46] *See infra* at III.C.1 for a complete description of the intersection collision warning system user service.

[47] U.S. Department of Transportation, NHTSA, *Synthesis Report: Examination of Target Vehicular Crashes and Potential ITS Countermeasures* at 2-2 (June, 1995).

[48] *National Program Plan* at 7.7.2.

in traffic congestion.[49] These and other DSRC-based user services are described more fully below.

A. Existing DSRC-based Services

1. *Electronic Payment Services*

Electronic payment services allow travelers to pay for transportation services with electronic cards called "smart cards" or toll transponders. Smart cards and toll transponders provide a common electronic payment medium which can be used to pay toll road charges, parking fees, transit fares, drive-thru charges, rental car payments and a whole host of other vehicle-based financial transactions.[50] Toll transponders come in the form of a windshield tag which can be remotely scanned by a radio frequency interrogator attached to a toll booth or other roadside device. Smart cards may be stored-value, debit or credit cards, that contain intelligent chips to store and manipulate data, and which are capable of being interfaced with some types of toll transponders.[51]

Electronic payment services have already proven their effectiveness and marketability in the electronic toll collection context, an application authorized in the 902-928 MHz band under the Location and Monitoring Service.[52] In the two years since this application was authorized, demand for electronic toll collection systems from drivers and toll authorities has far exceeded

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[49] *Id.* This higher efficiency is accomplished by keeping traffic flowing at capacity and preventing roadway overload that results in stalled traffic.

[50] *National Program Plan* at 4.1.

[51] The term "smart card" refers to a broad range of card technologies. At a minimum, a smart card contains an imbedded integrated circuit chip containing memory and microprocessor. *See id.* at 4.1.5.2. DSRC-equipped electronic payment services use proximity cards which interface with a transceiver using radio-frequency technology (as opposed to metal-to-metal contact or magnetic induction). *Id.*

[52] *See infra* at IV.A. for a discussion of the Location and Monitoring Service.

expectations. DOT estimates that every toll operator in the country will be using an electronic toll collection system within the next decade. It is anticipated that, once sufficient spectrum becomes available, this level of demand will extend to other electronic payment services as well, like the parking payment, fare collection, drive-thru payment and rental car inventory and payment services described below.

a. Electronic Toll Collection

Electronic toll collection ("ETC") uses DSRC equipment to transfer vehicle identification and driver payment data to a toll collection facility and to update data on the vehicle's transponder while passing through a toll collection area. ETC allows drivers to pay tolls without stopping or slowing down from cruising speed by reading toll payment information off of a toll transponder.[53] To assure customers that correct transactions have transpired, confirmation of toll charges may appear on roadside message signs or on in-vehicle devices.[54]

ETC systems have already demonstrated their ability to increase the capacity of toll collection systems by up to 250 percent and to reduce noxious emissions by up to 83 percent.[55] In addition, ETC can dramatically reduce the administrative costs of operating toll collection facilities. On the Oklahoma Turnpike, for example, it costs $15,800 annually to operate an automated toll collection lane, compared to $176,000 annually to operate an attended lane.[56]

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[53] *National Program Plan* at 4.1.4.1.

[54] *Id.*

[55] U.S. Department of Transportation, "Intelligent Transportation Infrastructure Benefits: Expected and Experienced" at 13, *Operation Time Saver Press Kit* (January 1996) (attached as Appendix G).

[56] *Id.*

Consumers also recognize the benefits of ETC. Consumer demand for ETC systems has skyrocketed since they were widely introduced a couple of years ago. For example, the New York State Thruway Authority reports that approximately 40 percent of all of the Authority's toll transactions now use ETC technology.[57] Demand is even higher among regular commuters. Out of all of the a.m. peak period toll transactions at the Tappan Zee Bridge Toll Plaza, 75 percent use ETC.[58] Similarly, a survey of Route 93 drivers in New Hampshire found that nearly 50 percent would use an ETC system with a $15 charge for the transponder. Slightly more than 80 percent would buy a transponder that cost $15 and provided a 25 percent discount on tolls.[59]

The nation's first fully automated toll road began operating just over a year ago on a ten-mile stretch of Highway 91 in Orange County, one of the most congested stretches of road in the country. Over 30,000 vehicles per day opt to pay the toll (up to $2.50 during peak periods) on this privately-managed toll road, even though the corresponding unautomated highway lanes are free of charge.[60] The toll lanes attract commuters even when the free lanes are not congested, indicating that many drivers value the certainty associated with toll roads as highly as the quick commute.[61] The pay lanes also create incentives for carpooling by waiving the toll for car pools of at least three people.

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57 "TRANSMIT: An Advanced Traffic Management System" at 1.

58 *Id.*

59 U.S. Department of Transportation, *Case Studies of Market Research for Three Transportation Communication Products* at 19 (March 1994).

60 *See Message in a bottleneck* at 50.

61 *Id.*

b. Electronic Parking Payments

Electronic parking payment allows drivers to pay for parking without cash. Upon entry or exit from a parking lot, a scanner run across a smart card or toll transponder bills or debits the parking charge from the driver's account.[62] This application permits quicker entry to and exit from parking areas. It also demands fewer cashiers and administrative staff in a parking area, and reduces cash handling and losses from fraud.

2. *Commercial Vehicle Electronic Clearance*

Electronic clearance is another DSRC-based user service that has already been deployed along several key trucking corridors around the country and is highly in demand. In the past, commercial trucks and buses were required to make frequent stops at state and national check points and international borders where they underwent routine weight, credential and safety checks. Today, commercial vehicle electronic clearance enables regulatory authorities to check credentials, size, weight, cargo and selected safety information with high speed weigh-in-motion equipment, roadside transceivers, and DSRC transponders as a vehicle approaches a check point at mainline speed. If inspectors have concerns about the vehicle, it is signaled to pull in at the checkpoint for a safety inspection. Otherwise, the vehicle passes the checkpoint without stopping.

In several deployments around the country, electronic clearance has proven to save commercial vehicle operators and federal and state regulators significant time and money, improve trucking safety, simplify regulatory implementation and enforcement, and help implement national priorities like the North American Free Trade Act ("NAFTA"). For example, in 1984, a coalition of 14 states and British Columbia implemented a commercial vehicle electronic clearance

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[62] *National Program Plan* at 4.1.4.3.

project called HELP ("Heavy vehicle Electronic License Plate").[63] The project deployed a network of sensors at ports of entry (including international border crossings), weigh stations and other strategic locations from British Columbia southward along I-5 and from California eastward along I-10 and I-20 into Texas. The project has also equipped over 28,000 trucks with transponders attached to the truck's license plate.[64] By encoding the transponders with relevant information, the HELP system automatically captures and communicates information regarding vehicle registration, weight, speed and a host of other vital safety and administrative matters.[65]

Initially deployed as an operational test, HELP has made the transition to a self-supporting commercial enterprise that is now implementing innovations of its own to serve the needs of its members. For example, HELP is currently implementing an electronic purchase plan which allows fleet managers to purchase state permits in advance and transfer preclearance information to their trucks' transponders. Permits can then be electronically verified en route, improving vehicle operating time and reducing state administrative costs.[66]

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[63] French, R.L., "Intelligent Vehicle/Highway Systems in Action" at 27, *ITE Journal* (Nov. 1990) ("*IVHS in Action*").

[64] The HELP system is the forerunner of a more advanced electronic license plate ("ELP") system which will integrate a planar antenna and identification electronics into a vehicle's license plate (HELP transponders are attached but not integral to the license plate). The ELP provides multiple equipment interface advantages: (1) it allows the license plate to serve as a primary DSRC antenna for all direct short range communication electronics inside the vehicle (*e.g.*, in-vehicle signing electronics); (2) it makes integration of DSRC on production vehicles easier because the antenna mounting place is the same as the already designed license plate mount; (3) it improves the received signal level compared to in-vehicle mounted antennas; (4) it does not block part of the view through the windshield; and (5), in a state that adopts the ELP, it assures that all but a few vehicles will have basic DSRC capability.

[65] *IVHS in Action* at 27.

[66] FHWA, "Intelligent Transportation Systems (ITS) Projects" at 180. Delaware has had a similar electronic permit issuance program in place since 1987, and New York is currently implementing one. *See* Nozick, L.K. *et al.*, "Electronic Issuance of Special Hauling Permits," *Proceedings of the 1995 Annual Meeting of ITS America*, vol. 2 at 1071, 1072 (March 1995).

Other states are implementing similar operations. Trucks traveling through Kentucky on I-65 can bypass weigh stations by driving over weigh-in-motion scales. An audio signal inside the weigh station alerts the operator that a transponder-equipped truck has passed and transmits the relevant information.[67] Similarly, the Advantage I-75 project allows 4,000 transponder-equipped trucks to bypass 29 weigh and inspection stations from Florida to Michigan and into Canada.[68] This saves commercial vehicles travel time and administrative paperwork which increases efficiency and reduces operating costs for both the trucking company and the state DOT.

B. Emerging DSRC-based Services

This section describes those user services that are currently being developed and tested and that the ITS National Architecture recommends use DSRC as their short range communications link.

1. *Traffic Control*

The traffic control user service optimizes the movement of traffic on streets and highways. This service gathers traffic data from stationary traffic surveillance monitors and DSRC-equipped vehicles (acting as traffic "probes") and uses the data to assign rights-of-way to certain vehicle types. Rights-of-way are assigned through control of traffic signals, freeway ramps, reversible lanes, and information signs. For example, in Lexington, Kentucky, a computerized traffic signal control system has reduced "stop and go" traffic delays by 40 percent and reduced accidents by

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[67] Brown, R.C. and C.J. Santeiu, "ITS Trends in Freight Management and CVO Operations," *Proceedings of the 1995 Annual Conference of ITS America*, vol. 2 at 1065, 1067 (March 1995).

[68] *Id.*